

Claims

1. A method of labeling digital image data, comprising:
 - a) detecting edges defined by image data having a first resolution;
 - b) detecting edges defined by the image data having a second resolution;
 - c) combining results from a) with results from b) to define intermediate image data; and
 - d) associating a label with each pixel of the image data.
2. The method of claim 1, wherein the method operation of detecting edges defined by image data having a first resolution includes,
filtering the image data through a low pass filter.
3. The method of claim 1, wherein the method operation of detecting edges defined by image data having a first resolution includes,
suppressing halftone dots.
4. The method of claim 1, wherein the method operation of combining results from a) with results from b) to define intermediate image data includes,
performing a logical AND operation with the results from a) and the results from b).
5. The method of claim 4, wherein the method operation of combining results from a) with results from b) to define intermediate image data includes,
selecting halftone dots from data resulting from the logical AND operation.

6. The method of claim 1, wherein the method operation of associating a label with each pixel of the image data includes,

defining a neighborhood around each pixel of the intermediate image data;
counting values in the neighborhood; and
determining a region type associated with the neighborhood a value count.

7. The method of claim 1, wherein the method operation of associating a label with each pixel of the image data includes,

eliminating bleed-through.

8. A method for labeling and enhancing documents defined through digital data, comprising:

detecting edge data defined in a portion of the document;
identifying a region type associated with the portion of the document; and
labeling a pixel associated with the edge data based upon both the region type and a pixel neighborhood value.

9. The method of claim 8, wherein the digital data defining the document results from a scanning operation.

10. The method of claim 8, wherein the method operation of detecting edge data defined in a portion of the document includes;

detecting the edge data at multiple resolutions in a single pass.

11. The method of claim 8, wherein the method operation of detecting edge data defined in a portion of the document includes;

suppressing halftone dots prior to detecting the edge data.

12. The method of claim 8, wherein the method operation of identifying a region type associated with the portion of the document includes,

defining a neighborhood around the pixel;

counting values of the neighborhood; and

comparing the values to a threshold value.

13. The method of claim 12 wherein if a number of values is greater than the threshold value, then the neighborhood is a halftone neighborhood.

14. The method of claim 8, wherein the method operation of labeling a pixel associated with the edge data based upon both the region type and a pixel neighborhood value includes,

substantially eliminating bleed-through.

15. The method of claim 14, wherein the method operation of substantially eliminating bleed-through includes,

identifying a non-halftone region;

defining a neighborhood in a non-halftone regions;

calculating a variance associated with pixels in the neighborhood, wherein a value of the variance determines whether the neighborhood is a constant tone neighborhood.

16. A computer readable medium having program instructions for labeling digital image data, comprising:

program instructions for detecting edges defined by image data having a first resolution;

program instructions for detecting edges defined by the image data having a second resolution;

program instructions for combining data defined by the first resolution with data defined by the second resolution to define intermediate image data;

program instructions for associating a label with a portion of the image data.

17. The computer readable medium of claim 16, wherein the program instructions for detecting edges defined by image data having a first resolution includes, program instructions for filtering the image data through a low pass filter.

18. The computer readable medium of claim 16, wherein the program instructions for detecting edges defined by image data having a first resolution includes, program instructions for suppressing halftone dots.

19. The computer readable medium of claim 16, wherein the program instructions for associating a label with a portion of the image data includes,

program instructions for defining a neighborhood around each pixel of the intermediate image data;

program instructions for counting values in the neighborhood; and

program instructions for determining a region type associated with the neighborhood a value count.

20. A computer readable medium having program instructions for labeling and enhancing documents defined through digital data, comprising:

program instructions for detecting edge data defined in a portion of the document;

program instructions for identifying a region type associated with the portion of the document; and

program instructions for labeling a pixel associated with the edge data based upon both the region type and a pixel neighborhood value.

21. The method of claim 20, wherein the program instructions for detecting edge data defined in a portion of the document includes;

program instructions for detecting the edge data at multiple resolutions in a single pass.

22. The computer readable medium of claim 20, wherein the program instructions for detecting edge data defined in a portion of the document includes;

program instructions for suppressing halftone dots prior to detecting the edge data.

23. The computer readable medium of claim 20, wherein the program instructions for identifying a region type associated with the portion of the document includes,

program instructions for defining a neighborhood around the pixel;

program instructions for counting values of the neighborhood; and

program instructions for comparing the values to a threshold value.

24. A method for segmenting a compound document, comprising:
receiving image data;

processing the image data at both a first scale and a second scale; and

determining region types of the compound document according to a combination of processing output at the first scale and processing output at the second scale.

25. The method of claim 24, wherein the image data is scanned image data.

26. The method of claim 24, wherein the method operation of processing the image data at both a first scale and a second scale includes,

filtering the image data for the first scale;

performing edge detection on the filtered image data; and

performing edge detection on the image data at the second scale, wherein the processing occurs in a single pass.

27. The method of claim 24, wherein the method operation of processing the image data at both a first scale and a second scale includes,

processing the image data in one of a banded fashion and a blocked based fashion.

28. The method of claim 24, wherein the region types are selected from the group consisting of fine edge, course edge, halftone, and constant tone.

29. The method of claim 24, wherein the method operation of determining region types of the compound document according to a combination of processing output at the first scale and processing output at the second scale includes,

defining a neighborhood around a point of the compound document;

determining a density value for the neighborhood;

comparing the density value to a threshold density in order to identify a region type associated with the neighborhood.

30. A microprocessor configured to segment and enhance image data associated with a compound document, comprising:

- circuitry for labeling each pixel of the image data;
- circuitry for descreening halftone regions of the image data; and
- circuitry for enhancing each identified segment of the image data.

31. The microprocessor of claim 30, wherein the circuitry for labeling each pixel of the image data includes,

- circuitry for low pass filtering the image data;
- circuitry for detecting edges of both low pass filtered image data and non-low pass filtered image data; and
- circuitry for combining data corresponding to detected edges associated with low pass filtering and detected edges associated with non-low pass filtering.

32. The microprocessor of claim 30, wherein the circuitry for labeling each pixel of the image data includes,

- circuitry for establishing a neighborhood around a pixel of the image data;
- circuitry for counting pixel values in the neighborhood; and
- circuitry for comparing a counted pixel value in the neighborhood to a threshold value.

33. The microprocessor of claim 30, wherein the circuitry for labeling each pixel of the image data includes,

- circuitry for substantially eliminating bleed-through artifacts.

34. The microprocessor of claim 33, wherein the circuitry for substantially eliminating bleed-through artifacts includes,

circuitry for calculating a variance associated with pixels representing a portion of the image data.

35. An image replication device, comprising:

a labeling module configured to segment image data associated with a document, the image data having a halftone portion and a non-halftone portion, the labeling module including a first branch and a second branch, the first branch configured to suppress halftone dots of the halftone portion prior to detecting edge data of the document.

36. The image replication device of claim 35, wherein the second branch is configured to detect edge data of the document without suppressing halftone dots.

37. The image replication device of claim 35, wherein the labeling module includes logic configured to combine an output of the first branch with an output of the second branch to identify halftone dot locations.

38. The image replication device of claim 37, wherein the labeling module includes logic configured to count pixels in the halftone dot locations to identify halftone pixels.

39. The image replication device of claim 37, wherein the labeling module includes logic configured to calculate a variance in non-halftone dot location to identify constant tone region pixels.

40. The image replication device of claim 35, further comprising:

a descreening module configured to output low pass filtered values associated with halftone pixels; and

an enhancement module configured to compute a sharpening term to be applied to both fine edges and coarse edges.

41. The image replication device of claim 35, further comprising:

a scanner in communication with a copier pipeline, the copier pipeline including the labeling module; and

a printer in communication with the copier pipeline.